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In recent times there has appeared a number of reports on the influence of UV irradiation on the corrosion susceptibility of various metals and alloys [1-6]. The first of these reports [1] was for nickel in chloride solutions, where it was observed that illumination hindered the formation of pits. Subsequently, photoinhibition of pitting attack was reported for a number of other systems including iron [2,3], stainless steels Type 304 [4-6] and 316 [5,6]. These reports have shown that illumination leads to modifications to the properties of the passive films, which render them more resistant to the onset of pitting attack. However in contrast to these results, increased corrosion rates have been reported under illumination conditions for passive films formed on titanium in acidic media [7] and more recently on pure zinc in alkaline solutions [8].

In this paper, results are presented on the influence of UV illumination on the passive behaviour of zinc-containing alloys and pure zinc in chloride and non-chloride containing electrolytes with pH values between 7.0 and 13.0. Cyclic voltammetry, anodic polarisation, complex impedance measurements and Mott-Schottky analyses were used to study the influence of UV irradiation on the properties of the passive films, while the electrolyte solutions were analysed to quantify the amount of dissolved zinc. It was found that illumination of passive films on pure zinc caused photodecomposition of ZnO, which is known to be a major component of the passive films formed on zinc. A typical example of photo-activation of zinc in a neutral borate-containing electrolyte is shown in Figure 1. Under dark conditions the anodic current decreases with passive film growth and remains low and constant, however under illumination conditions complete activation of the zinc electrode occurs. A similar degree of activation is seen with the zinc-containing alloys. In Figure 2, a representative anodic polarisation plot recorded for Cu-Zn in a chloride-containing pH 9.2 electrolyte is shown under dark and illumination conditions. The breakdown potential, which is marked by the sharp increase in current, is decreased by some 350 mV under illumination conditions compared to the response under dark conditions.

These results are explained in terms of the n-type semiconducting properties of ZnO, which is present in the passive layers formed on Zn, and Zn alloys, and which undergoes a photodecomposition reaction on UV irradiation.

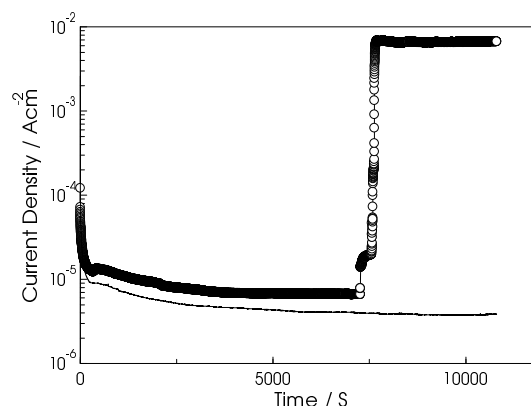


Figure 1: Potentiostatic current-time plots recorded for zinc in 0.015 M H_3BO_3 / 0.007 M $\text{Na}_2\text{B}_4\text{O}_7$ electrolyte. Recorded — under continuous dark conditions and \circ under illumination from 7.2×10^3 s to 7.7×10^3 s

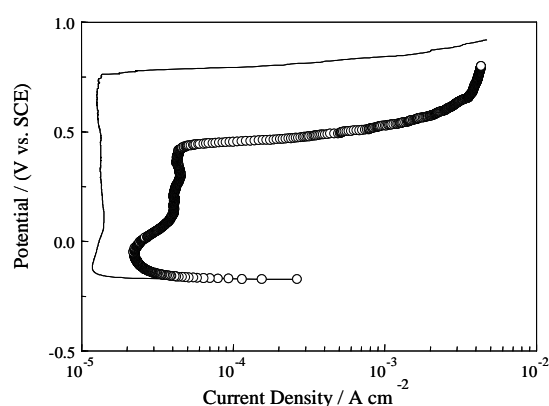


Figure 2: Anodic polarisation plots recorded in a chloride containing pH 9.2 electrolyte under — dark and \circ illumination conditions.

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